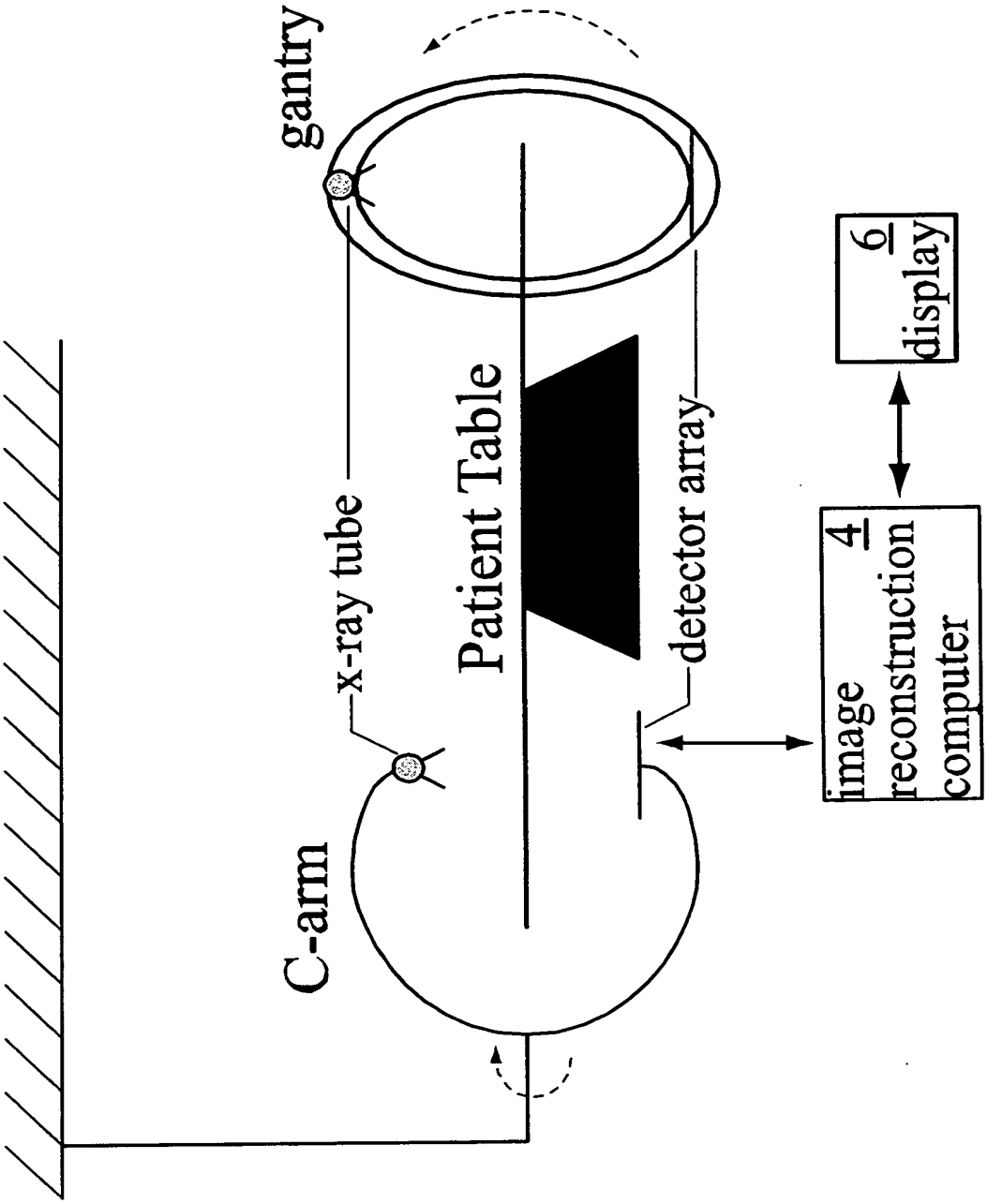

Fig. 1(Prior Art)

Fig. 2

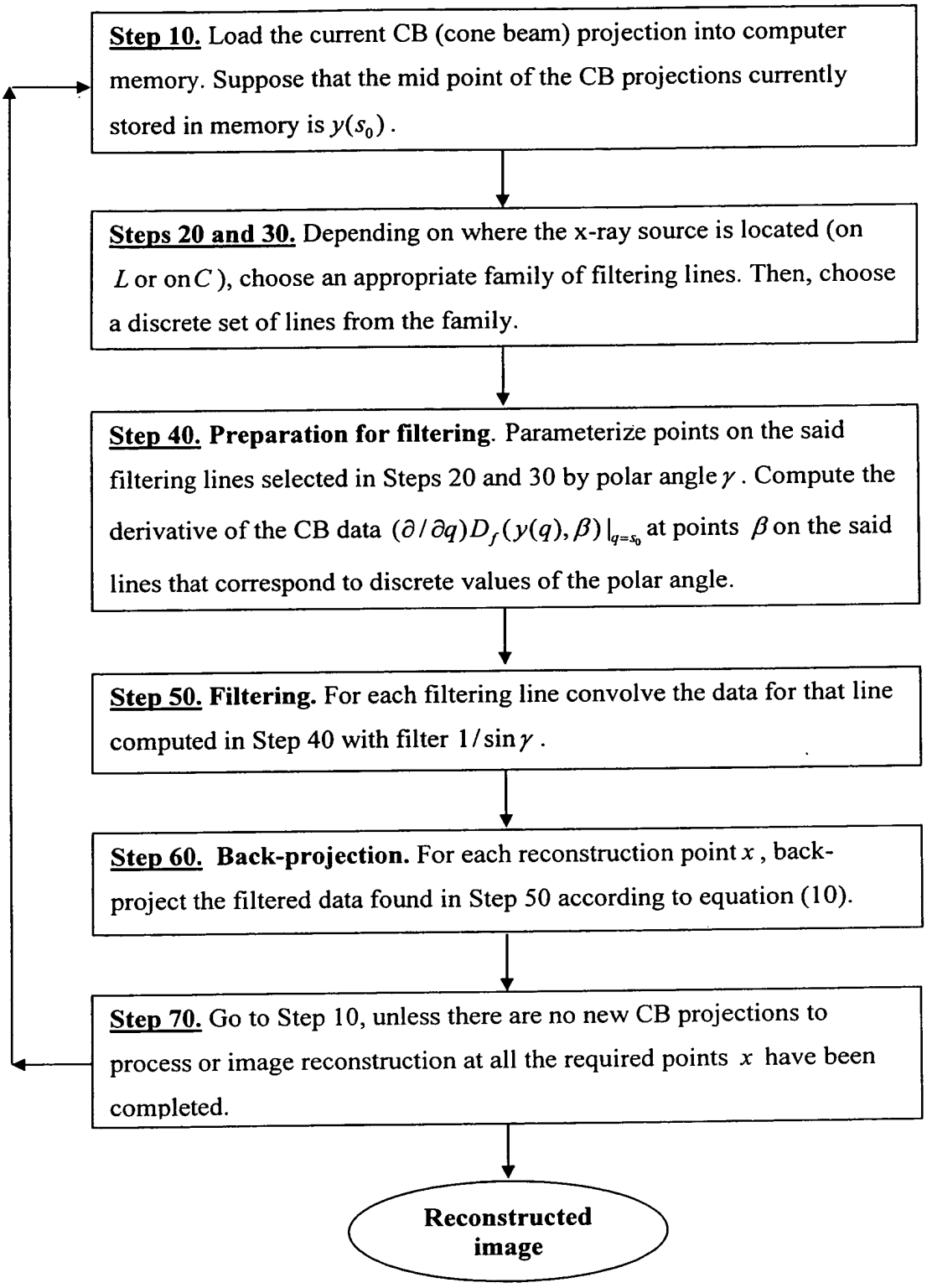
Step 10. Load the current CB (cone beam) projection into computer memory. Suppose that the mid point of the CB projections currently stored in memory is $y(s_0)$.
Steps 20 and 30. Depending on where the x-ray source is located (on L or on C), choose an appropriate family of filtering lines. Then, choose a discrete set of lines from the family.
Step 40. Preparation for filtering. Parameterize points on the said filtering lines selected in Steps 20 and 30 by polar angle γ. Compute the derivative of the CB data $(\partial/\partial q)D_f(y(q),\beta)|_{q=s_0}$ at points β on the said lines that correspond to discrete values of the polar angle.
Step 50. Filtering. For each filtering line convolve the data for that line computed in Step 40 with filter $1/\sin\gamma$.
Step 60. Back-projection. For each reconstruction point x, back-project the filtered data found in Step 50 according to equation (10).
Step 70. Go to Step 10, unless there are no new CB projections to process or image reconstruction at all the required points x have been completed.
Reconstructed image

Fig. 3

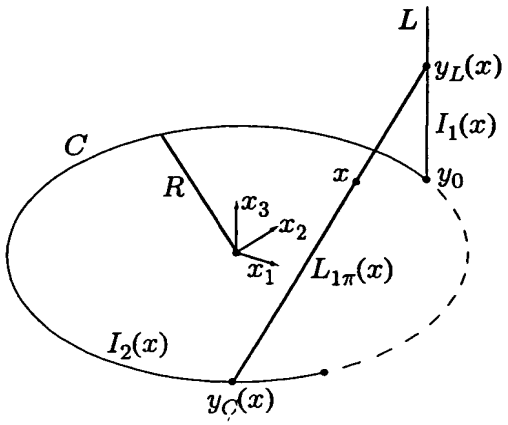

Fig. 4

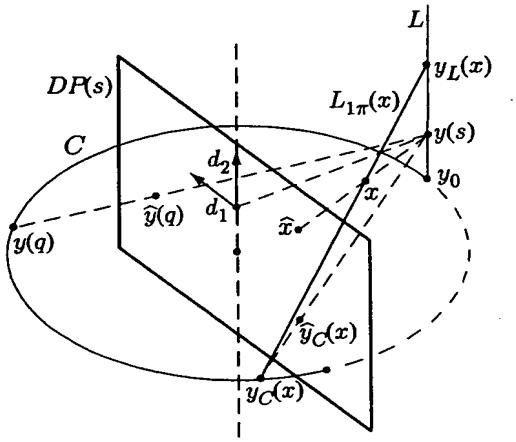

Fig. 5

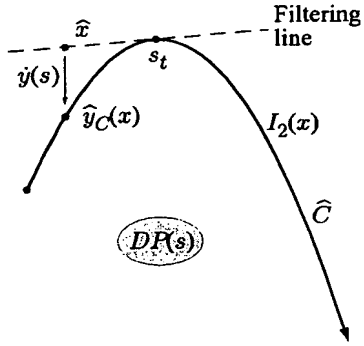

Fig. 6

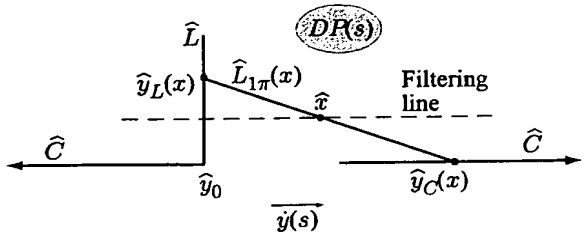

Fig. 7

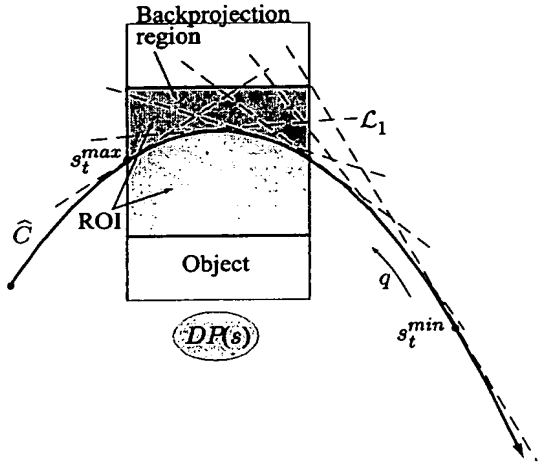
Backprojection region
$\mathcal{L}_1$
s_t^{max}
$\widehat{C}$
ROI
Object
q
$DP(s)$
s_t^{min}

Fig. 8

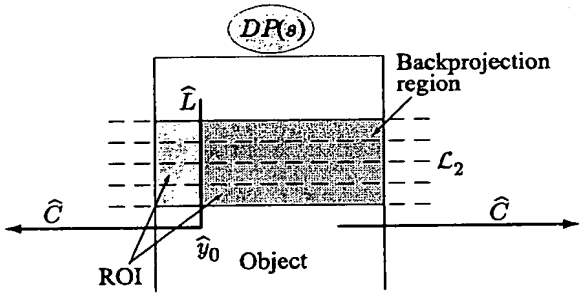
$DP(s)$
Backprojection region
$\widehat{L}$
$\mathcal{L}_2$
$\widehat{C}$
$\widehat{C}$
$\widehat{y}_0$
Object
ROI

Fig. 9

Step 20. Finding families of lines for filtering.

It is assumed the x-ray source is located on the line L.

Step 21. Choose a discrete set of values of the parameter s_t inside the interval $[s_t^{\min}, s_t^{\max}]$.

↓

Step 22. For each s_t chosen in Step 21 find a line tangent to the projected circle $\hat{C}$.

↓

Step 23. The collection of lines constructed in Step 22 is the required set of lines.

↓

Step 30

Fig. 10

Step 40. Preparation for filtering

Step 41. If the x-ray source is located on the line L, fix a filtering line $L_{flt} \in_1$. If the x-ray source is on the circle C, fix $L_{flt} \in_2$.

Step 42. Parameterize points on the said line by polar angle γ in the plane through $y(s_0)$ and L_{flt}.

Step 43. Choose a discrete set of equidistant values γ_j that will be used later for discrete filtering in Step 50.

Step 44. For each γ_j find the unit vector β_j which points from $y(s_0)$ towards the point on L_{flt} that corresponds to γ_j.

Step 45. Using the CB projection data $D_f(y(q),\Theta)$ for a few values of q close to s_0 find numerically the derivative $(\partial/\partial q)D_f(y(q),\Theta)|_{q=s_0}$ for all $\Theta = \beta_j$.

Step 46. Store the computed values of the derivative in computer memory.

Step 47. Repeat Steps 41-46 for all lines L_{flt} identified in Step 20. This way we will create the processed CB data $\Psi(s_0,\beta_j)$

Step 50

Fig. 11

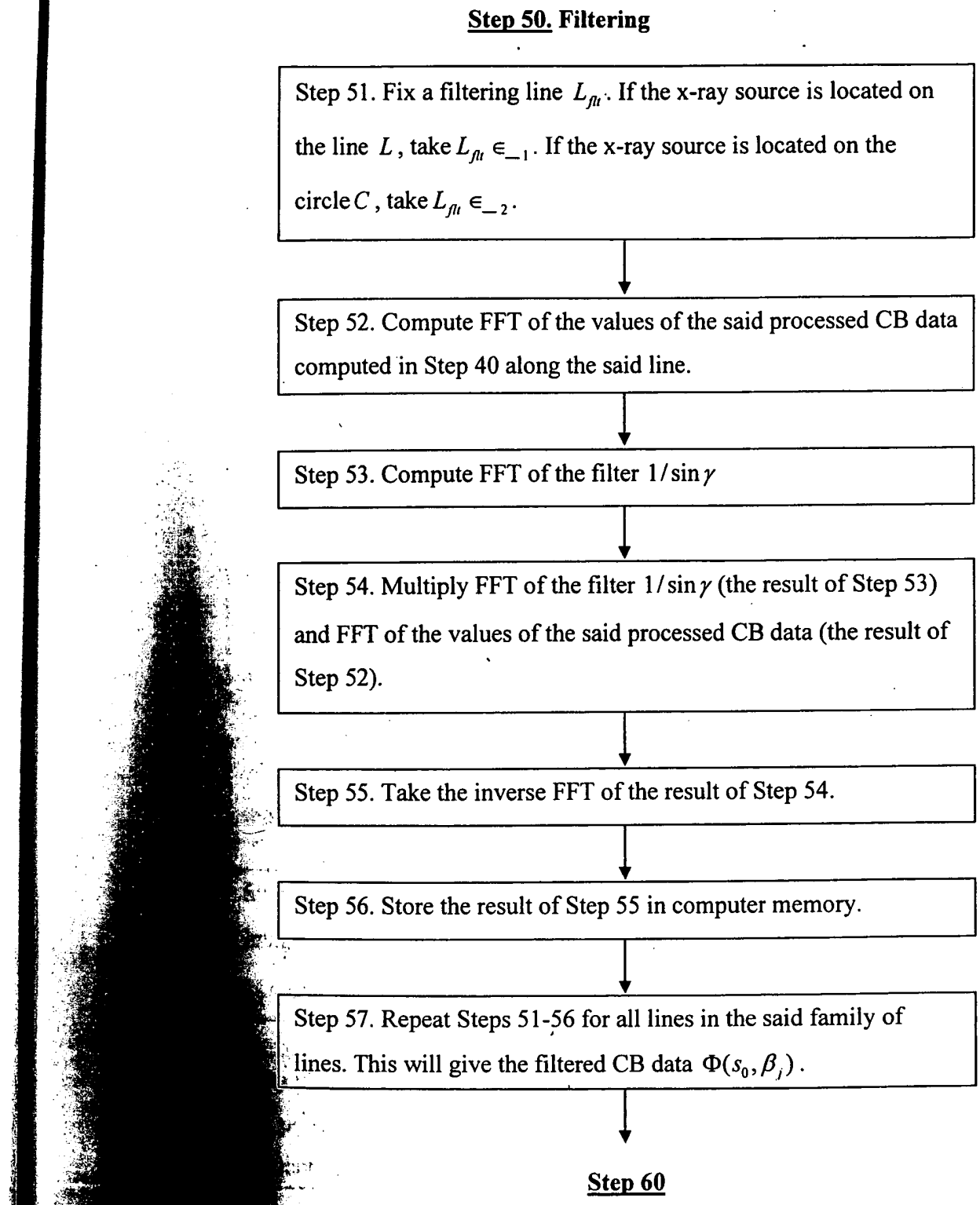
Step 50. Filtering
Step 51. Fix a filtering line L_{flt}. If the x-ray source is located on the line L, take $L_{flt} \in \_1$. If the x-ray source is located on the circle C, take $L_{flt} \in \_2$.
Step 52. Compute FFT of the values of the said processed CB data computed in Step 40 along the said line.
Step 53. Compute FFT of the filter $1/\sin\gamma$
Step 54. Multiply FFT of the filter $1/\sin\gamma$ (the result of Step 53) and FFT of the values of the said processed CB data (the result of Step 52).
Step 55. Take the inverse FFT of the result of Step 54.
Step 56. Store the result of Step 55 in computer memory.
Step 57. Repeat Steps 51-56 for all lines in the said family of lines. This will give the filtered CB data $\Phi(s_0, \beta_j)$.
Step 60

Fig. 12

Step 60. Back-projection

Step 61. Fix a reconstruction point x, which represents a point inside the patient where it is required to reconstruct the image.

Step 62. If $s_0 \in I_1(x) \cup I_2(x)$, then the said filtered CB data affects the image at x and one performs Steps 63-68. If $s_0 \notin I_1(x) \cup I_2(x)$, then the said filtered CB data is not used for image reconstruction at x. In this case go back to Step 61 and choose another reconstruction point.

Step 63. Find the projection $\hat{x}$ of x onto the detector plane $DP(s_0)$ and the unit vector $\beta(s_0, x)$, which points from $y(s_0)$ towards x.

Step 64. Identify filtering lines $L_{flt} \in \_1$ or $L_{flt} \in \_2$ (depending on where the x-ray source is located) and points on the said lines that are close to $\hat{x}$. This will give values of $\Phi(s_0, \beta_j)$ for β_j close to $\beta(s_0, x)$.

Step 65. With interpolation estimate the value of $\Phi(s_0, \beta(s_0, x))$ from the said values of $\Phi(s_0, \beta_j)$ for β_j close to $\beta(s_0, x)$.

Step 66. Compute the contribution from the said filtered CB data to the image being reconstructed at the point x by multiplying $\Phi(s_0, \beta(s_0, x))$ by $-\delta_k(s_0, x)/(2\pi^2 \mid x - y(s_0) \mid)$ (see (8) for definition of $\delta_k(s_0, x)$).

Step 67. Add the said contribution to the image being reconstructed at the point x according to a pre-selected scheme for approximate evaluation of the integral in equation (10).

Step 68. Go to Step 61 and choose a different reconstruction point x.